



Draft
Delisting Decision
for
Bear Creek
Assessment Unit ID # AL06030006-0103-103

Metals (Aluminum)

Alabama Department of Environmental Management
Water Quality Branch
Water Division
February 2014

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1.0 Executive Summary

Bear Creek, located in Marion County, is part of the Tennessee River Basin. Bear Creek originates from Upper Bear Creek Reservoir which occurs at the confluence of Little Bear Creek and Upper Bear Creek. Bear Creek flows northwest approximately 100 miles in stream length before reaching the Tennessee River. The impaired segment measures approximately 3 miles in length and contributes to a total drainage area of approximately 119.2 square miles. The Bear Creek watershed consists of mainly forested land and agriculture with a few surface mining areas. The whole watershed constitutes the 8-digit hydrologic unit code (HUC) 06030006. The impaired segment is listed in Table 1.

Bear Creek was first placed on the State of Alabama's §303(d) List for metals (aluminum) impairment in 1998 as a result of water quality data collected by ADEM from 1992 to 1996. The cause of impairment to the creek was originally believed to be surface mining. Subsequent data from the Alabama Department of Environmental Management's (ADEM) surface water quality monitoring program have shown no impairment with respect to metals (aluminum).

The most recent water quality data available for Bear Creek was collected in 2009 and 2012. ADEM collected 16 samples at BEA-1 and 16 samples at BEA-2. Applying EPA's aluminum criteria the data showed a small number of exceedances. The ecoregional comparison indicates that the creek shows no exceedances for aluminum.

The following report addresses the results of the delisting analysis for Bear Creek for metals. Based on the assessment of all available water quality data, ADEM has determined that Bear Creek is not impaired for aluminum and water quality standards are being attained. Therefore, ADEM will not develop a Total Maximum Daily Load (TMDL) for this pollutant in light of "more recent or accurate data," which is just cause for delisting a waterbody according to Title 40 of the Code of Federal Regulations (CFR), Part 130.7(b)(6)(iv).

Table 1: Bear Creek 2012 §303(d) List

ID	Use	Cause	Date of Data	Size	Downstream/Upstream Locations
AL06030006-0103-103	Swimming F&W	Metals(Aluminum)	1992-1996	3.0 miles	Mill Creek/ Upper Bear Creek Dam

2.0 Basis for §303(d) Listing

Section 303(d) of the Clean Water Act (CWA), as amended by the Water Quality Act of 1987 and EPA's Water Quality Planning and Management Regulations [(Title 40 of the Code of Federal Regulations (CFR), Part 130)], requires states to identify waterbodies which are not meeting water quality standards applicable to their designated use classifications. The identified waters are prioritized based on severity of pollution with respect to designated use classifications. Total maximum daily loads (TMDLs) for all pollutants causing violation of applicable water quality standards are established for each waterbody identified as impaired. Such loads are established at levels necessary to implement the applicable water quality standards with seasonal variations and margins of safety. The TMDL process establishes the allowable loading of pollutants or other quantifiable parameters for a waterbody, based on the relationship between pollution

sources and instream water quality conditions, so that states can establish water quality-based controls to reduce pollution from both point and nonpoint sources and restore and maintain the quality of their water resources (USEPA, 1991).

The State of Alabama does not have numeric criteria for aluminum. Aluminum is considered to be non-priority pollutant. Please refer to the following section for a more detailed explanation of the interpretation for aluminum. As mentioned in the Executive Summary, the ADEM data placing Bear Creek on the 1998 List was total recoverable data for aluminum collected from 1992 through 1996 at stations BEA-1 and BEA-2. Over 90% of the samples for both stations exceeded EPA’s recommended criterion of 0.087 mg/L. The ecoreference guideline for aluminum was lower than the median values at both stations. . The qualifying data is summarized below in Table 2 and included in Appendix 7.2.

Table 2: Data Summary for 303(d) Listing (1992-1996).

EPA recommended Criteria for Al: 0.087 mg/L	
Total No. of Values BEA-1:	11
No. of Exceedances at BEA-1:	10
Total No. of Values BEA-2:	4
No. of Exceedances at BEA-2:	4
Ecoreference guidelines for ecoregion: 65i & 68e	
Wt. Average of 90th %ile Total Al (mg/L):	0.336
Compare 90th %ile to:	median
Median at BEA-1	0.5
Median < Eco90%tile	No
Median at BEA-2	0.5
Median < Eco90%tile	No

3.0 Technical Basis for Delisting Decision

3.1 Water Quality Target Identification

Historically, in the absence of established numeric nutrient criteria, ADEM and/or EPA would use available data and information coupled with best professional judgment to determine overall use support for a given waterbody. Narrative criteria continue to serve as a regulatory basis for determining use support and making listing/delisting decisions of waters in regards to Alabama’s 303(d) List. ADEM’s Narrative Criteria, as shown in ADEM’s Administrative Code, Rule 335-6-10-.06, are as follows:

335-6-10-.06 Minimum Conditions Applicable to All State Waters. *The following minimum conditions are applicable to all State waters, at all places and at all times, regardless of their uses:*

(a) *State waters shall be free from substances attributable to sewage, industrial wastes or other wastes that settle to form bottom deposits which are unsightly, putrescent or interfere directly or indirectly with any classified water use.*

(b) *State waters shall be free from floating debris, oil, scum, and other floating materials attributable to sewage, industrial wastes or other wastes in amounts sufficient to be unsightly or which interfere directly or indirectly with any classified water use.*

(c) State waters shall be free from substances attributable to sewage, industrial wastes or other wastes in concentrations or combinations, which are toxic or harmful to human, animal or aquatic life to the extent commensurate with the designated usage of such waters.

ADEM's water quality regulations do not provide numeric water quality criteria for aluminum. For purposes of evaluating attainment of the above narrative criteria, ADEM will use both EPA's national recommended water quality criteria and ADEM's ecoregional reference guidelines. EPA's recommended criteria are published in section 304(a) of the Clean Water Act and lists guidelines for approximately 150 pollutants.

Most of the listed metals have both chronic and acute criteria. Chronic criteria are intended to protect the health of aquatic life from chronic exposure to a particular pollutant. The concentrations of total metals, as well as the dissolved fraction of the total, are strongly affected by low pH conditions. Dissolved forms of metals are more toxic than particulate forms because they are easily adsorbed or taken up across gills. Measurements of dissolved metals are considered to be a better indication of the fraction of total recoverable metals that would be biologically available and therefore potentially toxic to aquatic life (U.S. EPA. 1996). However, most water quality analyses measure the total recoverable amount of a given metal, and so the targets are usually stated in those terms. The fraction of total recoverable metal present in dissolved form will also depend on other conditions such as the water temperature, hardness, and concentrations of total suspended solids and organic carbon. However, when pH is low it is an important parameter promoting leaching from host material, dissolution and mobility of metals. The recommended freshwater chronic concentration criterion for aluminum is 0.087 mg/L.

3.2 Assessment of Ecoregion Reference Data

In 2010, ADEM published ecoregional reference guidelines for a number of parameters and pollutants. A listing of the guidelines can be found in Appendix 7.3. Reference streams, also referred to as "reference reaches" or "ecoregional reference sites," are defined as relatively homogeneous areas of similar climate, land form, soil, natural vegetation, hydrology, and other ecologically relevant variables (USEPA, 2000b) which have remained comparatively undisturbed or minimally impacted by human activity over an extended period of time in relation to other waters of the State. While not necessarily pristine or completely undisturbed by humans, reference streams do represent desirable chemical, physical and biological conditions for a given ecoregion that can be used for evaluation purposes.

The reference streams selected for a particular analysis depends primarily on the available number of reference streams and associated data within a particular ecoregion. Therefore, the total number of reference sites selected and the aerial scale (i.e. Ecoregion Level III, Level IV) used to represent a reference condition will often vary on a case-by-case basis. ADEM selected to use the 90th percentile of the data distributions from the selected reference sites. Employing values from the reference table, a weighted 90th percentile was calculated based upon Bear Creek's watershed area distribution. The Bear Creek watershed lies within two Level IV ecoregions (65i, 68e) as depicted in Figure 8 and is approximately 119.2 square miles in area. Due to the fact that the watershed covers two Level IV ecoregions a weighted 90th percentile value for aluminum and total dissolved solids was calculated and shown in Table 3.

Table 3: Aluminum Ecoregional Reference Weighted 90th percentile

ECO_NAME	ECO #	90 th tile Total Al (mg/L)	Compare to	90 th tile Dissolved Al (mg/L)	Compare to	Area (sq. miles)	% of watershed
Fall Line Hills	65i	0.801	median	0.1	median	15.9	13.3%
Dissected Plateau	68e	0.265	median	0.1	median	103.3	86.7%
Total						119.2	100
Wt. average (Total Al)						0.336mg/L	
Wt. average (Dissolved Al)						0.1mg/L	

Table 4: Total Dissolved Solids Ecoregional Reference Weighted 90th percentile

ECO_NAME	ECO#	TDS(mg/L)	Compare to	Area (sq. miles)	% of watershed
Fall Line Hills	65i	63.3	median	15.9	13.30%
Dissected Plateau	68e	84.8	median	103.3	86.70%
Total				119.2	100
Weighted average (TDS)				81.9 mg/L	

3.3 Data Availability and Analysis

It should be noted that even though Bear Creek was sampled prior to 2009, only the data that is approximately six years in age or less will be used in this analysis, which is consistent with *Alabama's Water Quality Assessment and Listing Methodology* (ADEM, 2012). The source of data that was utilized in the evaluation of Bear Creek is from ADEM's surface water quality monitoring plan. Physical, chemical, and biological data were collected at the following two sampling stations: BEA-1 and BEA-2. A description of the stations and their corresponding coordinates are listed in Table 5.

**Table 5: ADEM Sampling Stations on Bear Creek
 (Assessment ID # AL06030006-0103-103)**

Station Name	Agency Name	Latitude	Longitude	Description
BEA-1	ADEM	34.27167	-87.695	Outfall from Upper Bear Creek Reservoir Dam
BEA-2	ADEM	34.27694	-87.7186	Bear Creek @ junction of AL Hwy's 241 & 17

Both stations reported a small percentage of exceedances of EPA's recommended aluminum criteria. There were two exceedances out of 16 samples at station BEA-1 and 5 exceedances out of 16 samples value at station BEA-2. The median values at all stations were below the 90th percentile ecoregional reference guideline for aluminum.

Table 6: EPA's Aluminum (Al) criteria 0.087 mg/L

Station ID	# samples	Date of Samples	EPA's Al criteria	# of Exceedances
BEA-1	16	2009, 2012	0.087 mg/L	2
BEA-2	16	2009, 2012	0.087 mg/L	5

Table 7: Alabama’s Ecoregional Reference Guidelines for Aluminum (Al)

BEA-1			BEA-2		
	Al Dissolved	Al Total		Al Dissolved	Al Total
Mean:	0.0505	0.0809	Mean:	0.061	0.242
Median:	0.045	0.06	Median:	0.0505	0.0635
75th %tile:	0.06	0.0662	75th %tile:	0.06	0.242
90th %tile:	0.074	0.12	90th %tile:	0.091	0.0635
Ecoref 90th %tile:	0.1	0.336	Ecoref 90th %tile:	0.1	0.336
Median<Eco90%tile:	yes	yes	Median<Eco90%tile:	yes	yes

In addition, field data was analyzed to determine if the Aluminum concentrations were affecting other water quality parameters. The field data, summarized in table 8 and 9, shows no exceedances of the following parameters: pH, DO, temperature, turbidity, and TDS. These evaluations were based on ADEM’s criteria for pH, temperature, DO, and turbidity. TDS was analyzed by comparing the weighted average 90th percentile to the median values. The water quality data does not indicate any impairment due to metal. A complete list of available data used in this delisting report and pictures of both stations can be found in Appendices 7.2-7.4.

Table 8: ADEM’s Field Criteria

pH Analysis	6<X<8.5	Temp Analysis	X<90°F
Max pH	8.09	Max temp	25.59
Min pH	6.83	Min temp	11.79
Number samples	32	Number samples	32
% Exceedances	0	% Exceedances	0

DO Analysis	X>5	Turbidity Analysis	X<50NTU
Number samples	32	Number samples	32
# Exceedances	0	# Exceedances	0
% Exceedances	0	% Exceedances	0

Table 9: Ecoregional Reference Guideline for TDS

TDS Analysis	Median<81.9
Number samples	32
Median BEA-1	43
Median BEA-2	49.5
# Exceedances	0
% Exceedances	0

4.0 Source Assessment

4.1 Point Sources

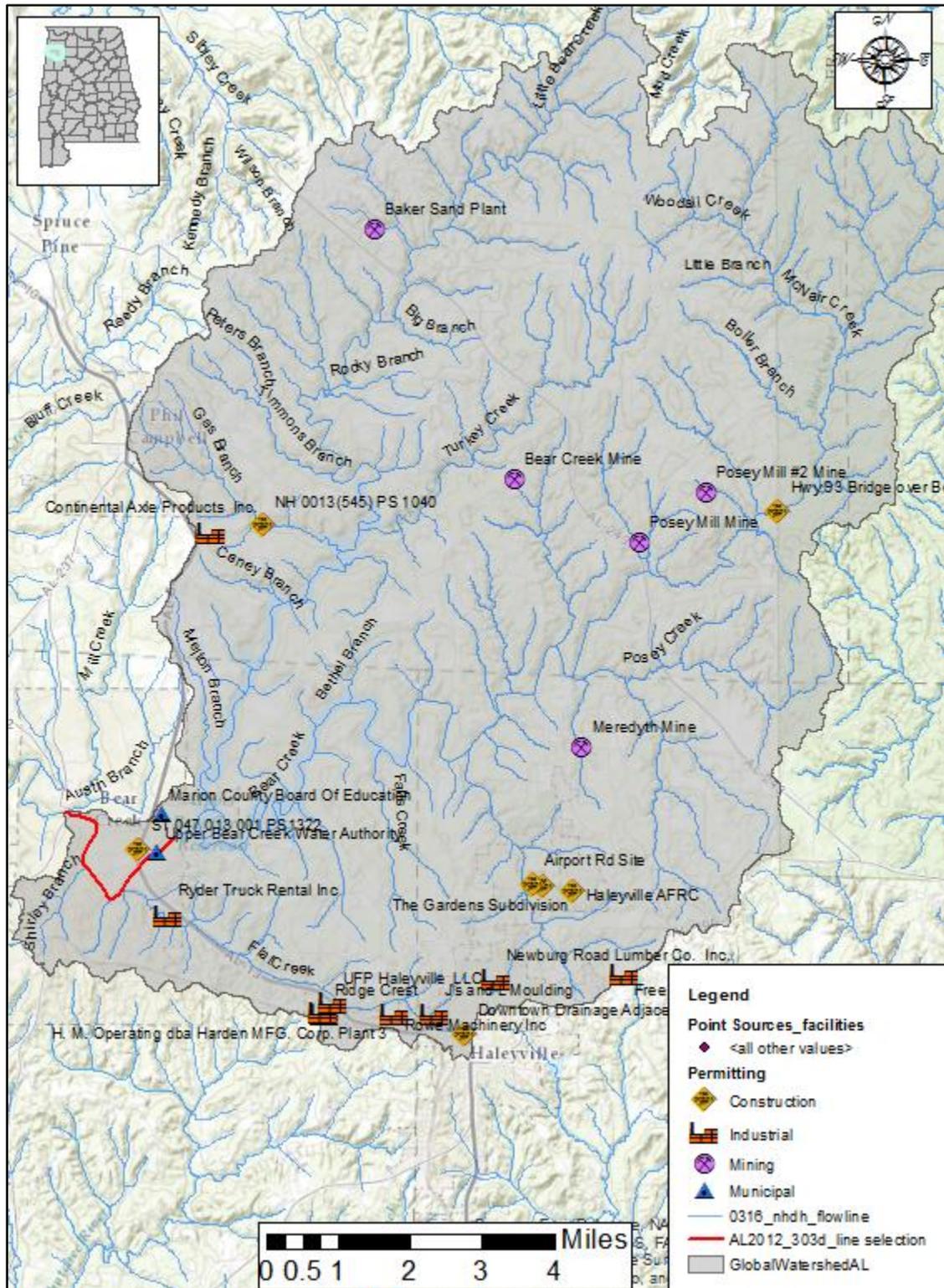
National Pollutant Discharge Elimination System (NPDES) permitted facilities are an important consideration in evaluating a watershed. There are five listed mining facilities in the Bear Creek watershed; however, only one facility named Baker Sand Plant is actively discharging. Barnett Branch, a tributary to Bear Creek, is the receiving stream of Baker Sand Plant’s discharge. There are two active discharges in the Bear Creek watershed from the following municipal sources: Upper Bear Creek Water Authority and

Marion County Board Of Education. Nine industrial facilities are actively discharging to such streams as Flat Creek, Quarter Creek, Flat Rock Creek and Gas Branch. Table 7 lists relevant data for the facilities. Figure 2 is map of their respective locations in the watershed.

Table 10: Point Sources- NPDES Regulated Facilities in the Bear Creek Watershed

Facility	Permit #	Permit type	Active Discharge/Receiving Stream
Downtown Drainage Adjacent to Hwy 13	ALR109151	Construction	No/Flat Creek
Haleyville AFRC	ALR109693	Construction	No/Quarter Creek
The Gardens Subdivision	ALR16C129	Construction	No/Quarter Creek
Airport Rd Site	ALR16EFLG	Construction	No/Quarter Creek
ST 047 013 001 PS1322	ALR109615	Construction	No/Bear Creek
NH 0013(545) PS 1040	ALR109021	Construction	No/Gas Branch
Hwy 93 Bridge over Bear Creek	ALR16EFEL	Construction	No/Bear Creek
Ridge Crest	ALG060461	Industrial	Yes/Flat Creek
Rowe Machinery Inc.	ALG140259	Industrial	Yes/Flat Creek
J's and L Moulding	ALG060475	Industrial	Yes/Flat Creek
H. M. Operating dba Harden MFG. Corp. Plant 3	ALG060292	Industrial	Yes/Flat Creek
UFP Haleyville LLC	ALG060265	Industrial	Yes/Flat Creek
Newburg Road Lumber Co. Inc.	ALG060138	Industrial	Yes/Quarter Creek
Free State Lumber Company Inc.	AL0064742	Industrial	Yes/Quarter Creek
Ryder Truck Rental Inc.	ALG140445	Industrial	Yes/Flat Rock Creek
Continental Axle Products Inc.	ALG120415	Industrial	Yes/Gas Branch
Meredyth Mine	AL0078280	Mining	No/Whitehead Creek
Posey Mill Mine	AL0080161	Mining	No/Swan Branch
Posey Mill #2 Mine	AL0080608	Mining	No/Swan Branch
Bear Creek Mine	AL0074373	Mining	No/Pretty Branch
Baker Sand Plant	AL0022519	Mining	Yes/Barnett Branch
Upper Bear Creek Water Authority	AL0052311	Municipal	Yes/Bear Creek
Marion County Board Of Education	AL0054593	Municipal	Yes/Bear Creek

Figure 2: Point Source Locations within the Bear Creek Watershed



4.2 Nonpoint Sources

Nonpoint impacts in the Bear Creek watershed are considered to come from its land uses. Land use percentages were determined from the 2006 National Land Cover Dataset (NLCD). Table 8 lists the land use areas and percentages in the watershed as shown in Figure 3. Figure 4 is a map of the watershed's land use. As can be seen from an inspection of the table and map, the predominant land use in the watershed is forested with a percentile value of 52%. The total drainage area for Bear Creek is 119.18 square miles. Hay/pasture and cultivated crops account for the second largest use of land in the watershed with 27% of the total land use. A small percentage of land is developed.

Figure 3: Pie Chart of Land Use Distribution in Bear Creek Watershed

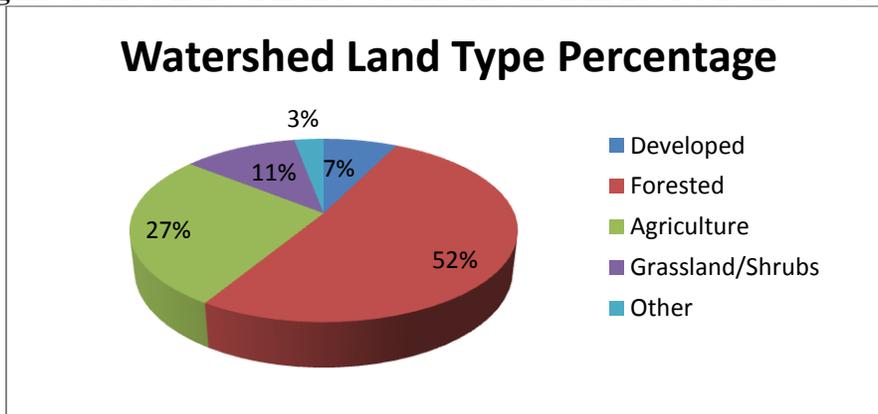
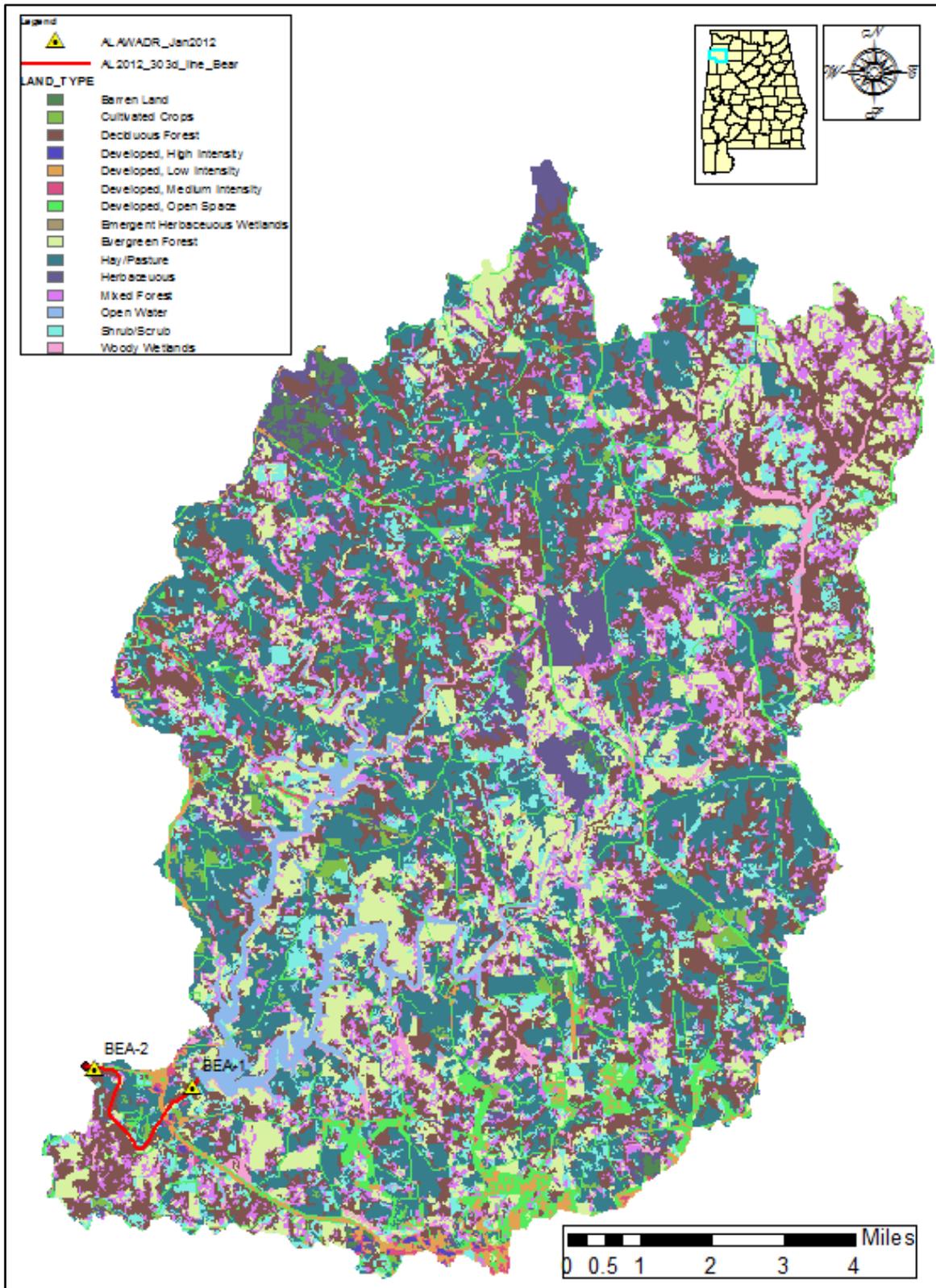


Table 11: Land Use Data

Land Use Description	Square Miles	Percent (%)
Open Water	2.81	2.36
Developed, Open Space	6.51	5.46
Developed, Low Intensity	1.77	1.49
Developed, Medium Intensity	0.38	0.32
Developed, High Intensity	0.11	0.09
Barren Land	0.69	0.58
Deciduous Forest	28.76	24.14
Evergreen Forest	17.76	14.91
Mixed Forest	12.63	10.60
Shrub/Scrub	8.55	7.17
Herbaceous	5.00	4.19
Hay/Pasture	30.48	25.58
Cultivated Crops	1.64	1.37
Woody Wetlands	2.06	1.73
Emergent Herbaceous Wetlands	0.02	0.02
Total Land Use	119.2	100
Cumulative Land Use	Square Miles	Percent (%)
Developed	8.77	7.36
Forested	61.24	51.39
Grassland/Shrubs	32.12	26.95
Agriculture	13.54	11.36
Other	3.50	2.94
Total Land Use	119.2	100

Figure 4: Land Use Map of the Bear Creek Watershed



5.0 Conclusions

From examination of all available water quality data and information provided for Bear Creek, ADEM has determined that impairment due to metals does not currently exist. Therefore, ADEM will not develop a TMDL for this pollutant in light of “more recent or accurate data,” which is just cause for delisting a waterbody according to Title 40 of the Code of Federal Regulations (CFR), Part 130.7(b)(6)(iv). Bear Creek will be proposed for delisting as a part of the development process for Alabama’s 2014 §303(d) *List of Impaired Waters*.

6.0 Public Participation

As part of the public participation process, this Delisting Decision (DD) will be placed on public notice and made available for review and comment. The public notice will be prepared and published in the major daily newspapers in Montgomery, Huntsville, Birmingham, and Mobile, as well as submitted to persons who have requested to be on ADEM’s postal and electronic mailing distributions. In addition, the public notice and subject DD will be made available on ADEM’s website: www.adem.state.al.us. The public can also request paper or electronic copies of the DD by contacting Mr. Chris Johnson at 334-271-7827 or cljohnson@adem.state.al.us. The public will be given an opportunity to review the DD and submit comments to the Department in writing. At the end of the public review period, all written comments received during the public notice period will become part of the administrative record. ADEM will consider all comments received from the public prior to finalization of this DD and subsequent submission to EPA Region 4 for final review and approval.

7.0 Appendices

7.1 References

1. Alabama Department of Environmental Management, 1998-2012 Section 303(d) List
2. ADEM Trend monitoring program. 1992-1996. ADEM.
3. Alabama's Water Quality Survey of Bear Creek. 2009 & 2012. ADEM.
4. Alabama's 303(d) Monitoring Program. 2009 & 2012. ADEM.
5. ADEM Administrative Code, 2002. Water Quality Program, Chapter 335-6-10, Water Quality Criteria, and Chapter 335-6-11, Use Classifications for Interstate and Intrastate Waters.
6. United States Environmental Protection Agency. 1991. Guidance for Water Quality-Based Decisions: The TMDL Process, Office of Water, EPA 440/4-91-001.
7. Alabama Department of Environmental Management, Water Quality Assessment and Listing Methodology (ADEM 2012).
8. USEPA 304(a) National Recommended Water Quality Criteria (EPA OST, 2009).
9. EPA. 1996 The Metals Translator: Guidance For Calculating a Total Recoverable Permit Limit from a Dissolved Criterion. Environmental Protection Agency Office of Water. EPA# 823-B-96-007.

7.2 Water Quality Data

**Table 12: Bear Creek Downstream of Upper Bear Creek Reservoir –Marion County
 ADEM Trend Monitoring Station BEA-1
 34° 16' 18"N 087° 41' 42"W**

Parm#	Value	Rmk	Short Name	Station Number	Date	Time
1105	1000	K	ALUMINUM AL,TOT UG/L	BEA-1	9/9/1993	1200
1105	2650		ALUMINUM AL,TOT UG/L	BEA-1	12/9/1993	1045
1105	80		ALUMINUM AL,TOT UG/L	BEA-1	3/15/1994	1027
1105	500	K	ALUMINUM AL,TOT UG/L	BEA-1	6/9/1994	1110
1105	500	K	ALUMINUM AL,TOT UG/L	BEA-1	9/8/1994	1045
1105	500	K	ALUMINUM AL,TOT UG/L	BEA-1	12/21/1994	1030
1105	1740		ALUMINUM AL,TOT UG/L	BEA-1	3/16/1995	1050
1105	500	K	ALUMINUM AL,TOT UG/L	BEA-1	6/8/1995	1100
1105	500	K	ALUMINUM AL,TOT UG/L	BEA-1	9/7/1995	1115
1105	630		ALUMINUM AL,TOT UG/L	BEA-1	12/12/1995	1200
1105	1000		ALUMINUM AL,TOT UG/L	BEA-1	3/21/1996	1030

**Table 13: Bear Creek at Alabama Highway 241 –Marion County
 ADEM Trend Monitoring Station BEA-2
 34° 16' 37"N 087° 43' 07"W**

Parm#	Value	Rmk	Short Name	Station Number	Date	Time
1105	1500		ALUMINUM AL,TOT UG/L	BEA2	12/17/1992	1100
1105	500	K	ALUMINUM AL,TOT UG/L	BEA2	3/18/1993	1140
1105	500	K	ALUMINUM AL,TOT UG/L	BEA2	6/10/1993	1200
1105	500	K	ALUMINUM AL,TOT UG/L	BEA2	9/8/1994	1110

Table 14: Bear Creek Water Quality Data (2009, 2012).

Station	Activity	DO	Turb	TDS	TDS	T H2O	pH_SU	Al Dis	Al Dis dc	Al	Al Tot dc
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ID	Date	(mg/L)	(NTU)	(mg/L)	dc	C	(mg/L)	(mg/L)		Tot(mg/L)	
BEA-1	3/30/2009	10.83	10.9	38		11.83	7.2	0.088	JI	0.153	JI
BEA-1	4/7/2009	10.53	18.9	43		12.86	7.61	0.12	JI	0.43	
BEA-1	5/27/2009	8.88	3.82	47		19.4	7.22	0.06	< MDL .06	0.085	JI
BEA-1	6/10/2009	8.08	8.07	34		17.65	8.06	0.06	< MDL .06	0.087	JI
BEA-1	7/15/2009	6.35	3.16	42		21.86	7.67	0.06	< MDL .06	0.06	< MDL .06
BEA-1	8/4/2009	6.52	4.58	54		28.57	6.96	0.06	< MDL .06	0.06	< MDL .06
BEA-1	9/9/2009	5.63	4.19	47		22.73	7.17	0.06	< MDL .06	0.06	< MDL .06
BEA-1	10/6/2009	9.06	5.46	43		21.23	7.91	0.06	< MDL .06	0.06	< MDL .06
BEA-1	4/26/2012	9.81	3.88	62	JH	13.57	7.63	0.03	< MDL .03	0.06	JI
BEA-1	5/22/2012	8.19	5.35	43		24.08	7.72	0.03	< MDL .03	0.039	JI
BEA-1	6/25/2012	7.57	8.98	58	JQ1	19.7	7.05	0.03	< MDL .03,JQ	0.03	< MDL .03
BEA-1	7/24/2012	7.1	2.79	44		24.15	6.83	0.03	< MDL .03,JQ1	0.036	JI
BEA-1	8/8/2012	7.45	3.05	39	JQ	24.1	6.91	0.03	< MDL .03	0.03	< MDL .03
BEA-1	9/4/2012	8.18	3.71	36		23.74	7.3	0.03	< MDL .03,JQ1	0.03	< MDL .03
BEA-1	10/30/2012	9.32	3.42	37		16.66	7.39	0.03	< MDL .03	0.044	JI
BEA-1	11/27/2012	10.54	2.51	47		12.34	7.21	0.03	< MDL .03	0.03	< MDL .03
BEA-2	3/30/2009	10.85	9.95	43		12.52	7.21	0.095	JI	0.153	JI
BEA-2	4/7/2009	11.14	14.9	48		12.28	7.66	0.087	JI	0.274	JI
BEA-2	5/27/2009	8.83	3.62	57		19.66	7.31	0.06	< MDL .06	0.186	JI
BEA-2	6/10/2009	9.2	3.32	51		22.88	7.99	0.06	< MDL .06	0.06	< MDL .06
BEA-2	7/15/2009	8.13	2.25	58		25.59	8.01	0.06	< MDL .06	0.06	< MDL .06
BEA-2	8/4/2009	8.3	3.3	55		28.8	7.29	0.06	< MDL .06	0.06	< MDL .06
BEA-2	9/9/2009	7.2	53	73		23.71	7.53	0.243	JI	2.52	
BEA-2	10/6/2009	8.78	5.64	54		20.82	7.6	0.06	< MDL .06	0.076	JI
BEA-2	4/26/2012	10.07	2.25	43	JH	15.03	8.09	0.03	< MDL .03	0.071	JI
BEA-2	5/22/2012	8.03	2.44	42		22.02	7.93	0.03	< MDL .03	0.035	JI
BEA-2	6/25/2012	8.52	2.25	51	JQ1	20.93	7.83	0.03	< MDL .03,JQ	0.03	< MDL .03
BEA-2	7/24/2012	7.27	2.3	45		24.85	7.43	0.041	JQ1	0.047	JI
BEA-2	8/8/2012	6.85	3.63	51	JQ	24.9	7.26	0.03	< MDL .03	0.067	JI
BEA-2	9/4/2012	7.94	6.94	48		23.75	7.61	0.03	< MDL .03,JQ1	0.168	JI
BEA-2	10/30/2012	9.79	2.1	39		14.7	7.32	0.03	< MDL .03	0.03	< MDL .03
BEA-2	11/27/2012	10.42	2.02	45		11.79	7.44	0.03	< MDL .03	0.036	JI

7.3 Ecoregional Reference Guidelines

Figure 5: Ecoregional Map of Alabama

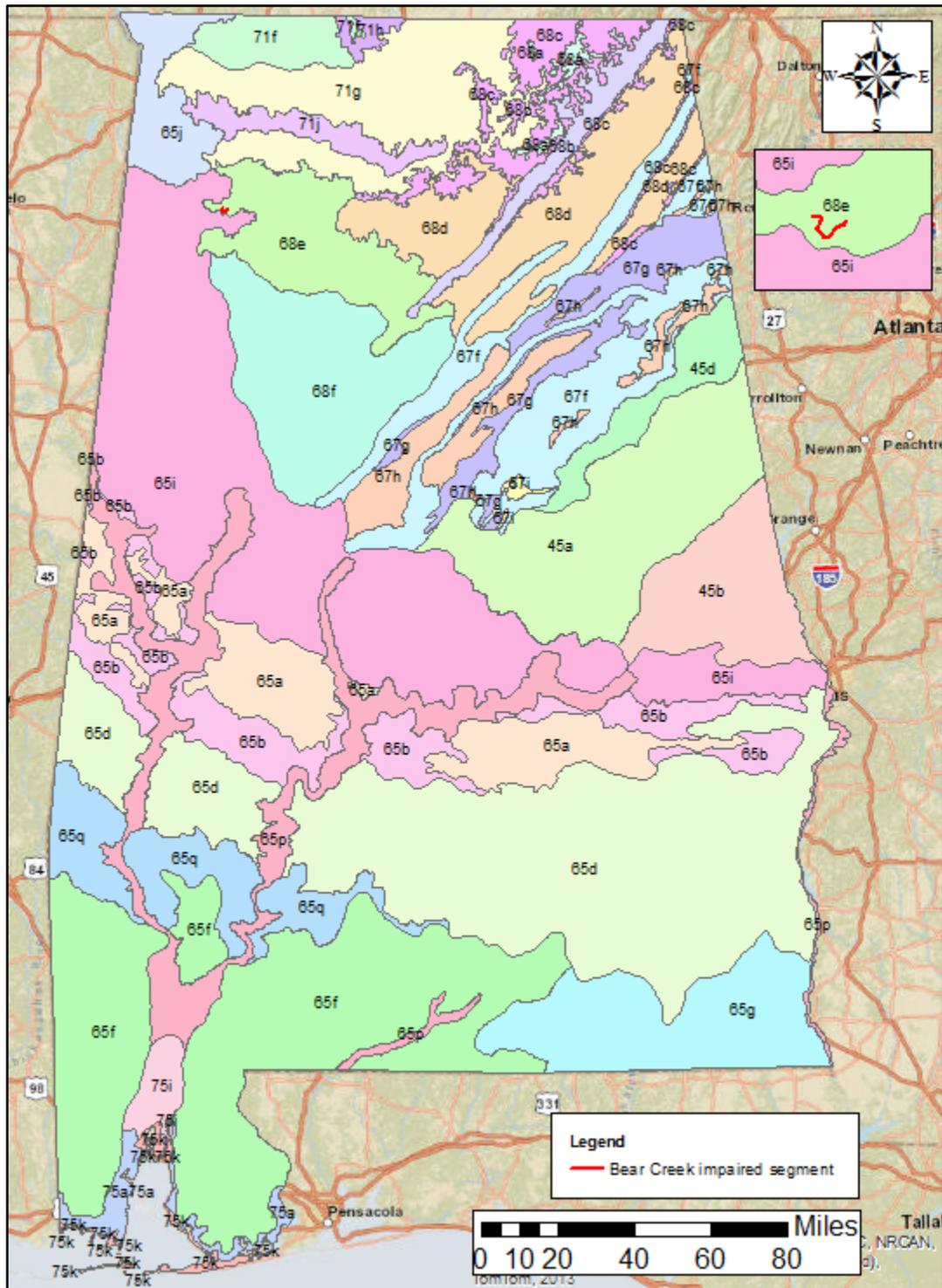


Figure 6: 2010 Ecoregional Reference Guidelines

Parameters	Basis of comparison	Result to compare	Level 4	Level 4	Level 3	Level 4	Level 3	Level 4	Level 3	Level 4	Level 3								
			45a	45d	45	65ab	65f	65g	65i	65j	65q	67f	67h	67	68d	68e	68	71f	71
Physical																			
Temperature (°C)	90th %ile	Median	24.656	25	25	27	24.6	27	25	24	27	24	26	25.7	25	23.48	24	22.12	22.586
Turbidity (NTU)	90th %ile	INDIVIDUAL	21.7	6.823	15	49.56	9.7	13.05	26.21	10.73	42.3	6.622	10.787	8.824	9.667	9.025	10.1	3.693	11.1
Total Dissolved Solids (mg/L)	90th %ile	Median	67.9	85.4	80	162.8	53.4	97.4	63.3	167.6	103.4	165	79.4	151.2	118	84.8	97.2	79.6	150.5
Total Suspended Solids (mg/L)	90th %ile	Median	16	12	15	45	13.2	16.3	27.5	26.9	104.6	11.3	12.7	12.4	27	10	14	9.6	8.9
Specific Conductance (µmhos)	Median	Median	40.1	37	39.05	129.7	20.4	53.4	25.8	70	72.5	207	34.35	86	49.5	37	39.15	96	109
Hardness (mg/L)	Median	Median	10.65	11.1	11	56	14	14.2	6.52	82.1	34.6	94.05	8.56	42.3	16.2	10	12.15	47.2	56
Alkalinity (mg/L)	90th %ile	Median	21.8	23.5	23.01	84.41	11.8	21.85	21.05	130.6	36.36	121.7	16.54	117.72	21	44.2	42.2	57.492	109.4
Stream Flow (cfs)																			
Chemical																			
Dissolved Oxygen (mg/L)	10th %ile	Median	7.665	7.6	7.6	5.1	6.94	4.484	6.692	7.64	6.8	7.44	7	7	5.609	7.51	6.79	8.113	7.61
pH (su)	10th %ile	Median	6.5	6.787	6.64	6.758	4.436	5.69	5.82	6.31	6.6	6.398	6.69	6.768	6.482	6.522	6.5	7.162	7.345
pH (su)	90th %ile	Median	7.68	7.679	7.7	8.052	6.55	6.815	7.18	8.1	7.74	8.294	8	8.278	7.352	7.852	7.84	8.35	8.34
Ammonia Nitrogen (mg/L)	90th %ile	Median	0.0078	0.011	0.0105	0.048	0.046	0.02	0.091	0.093	0.074	0.023	0.031	0.0346	0.119	0.095	0.1007	0.023	0.023
Nitrate+Nitrite Nitrogen (mg/L)	90th %ile	Median	0.1241	0.072	0.0974	0.286	0.326	0.243	0.276	0.344	0.0634	0.261	0.0688	0.2403	1.202	0.456	0.6191	0.6895	1.42
Total Kjeldahl Nitrogen (mg/L)	90th %ile	Median	0.4048	0.26	0.2845	0.987	0.418	0.583	0.678	0.486	0.6346	0.431	0.5107	0.5826	1.46	0.66	0.733	0.624	0.466
Total Nitrogen (mg/L)	90th %ile	Median	0.5311	0.322	0.4002	1.1634	0.64	0.773	0.851	0.806	0.6921	0.684	0.6937	0.7109	2.269	0.919	1.4169	1.295	1.57
Dissolved Reactive Phosphorus (mg/L)	90th %ile	Median	0.0214	0.027	0.0243	0.0618	0.026	0.024	0.023	0.017	0.0193	0.017	0.0162	0.017	0.011	0.019	0.0182	0.017	0.0155
Total Phosphorus (mg/L)	90th %ile	Median	0.0663	0.054	0.0599	0.201	0.04	0.07	0.068	0.058	0.064	0.051	0.0429	0.0566	0.049	0.05	0.05	0.1059	0.0497
CBOD-5 (mg/L)	90th %ile	Median	2.57	2.37	2.4	3.2	1.96	2.65	2	2.53	2.3	1.78	2.58	2.3	1.86	1.9	1.9	1.1	1.1
Chlorides (mg/L)	90th %ile	Median	4.778	4.029	4.495	12.032	6.692	6.066	4.285	5.247	5.95	4.266	3.61	3.89	9.18	10.51	6.37	2.412	2.622
Total Metals																			
Aluminum (mg/L)	90th %ile	Median	0.2437	0.156	0.1954	1.181	0.489	0.273	0.801	0.405	1.561	0.21	0.356	0.4114	0.155	0.265	0.3055	0.1954	0.127
Iron (mg/L)	90th %ile	Median	1.094	0.565	0.8722	2.362	1.352	3.976	3.548	0.839	2.13	0.893	0.733	0.9803	0.686	1.047	1.046	0.4085	0.4294
Manganese (mg/L)	90th %ile	Median	0.0554	0.065	0.057	0.215	0.044	0.737	0.809	0.081	0.113	0.067	0.052	0.0628	0.184	0.056	0.1553	0.025	0.025
Dissolved Metals																			
Aluminum (mg/L)	90th %ile	Median	0.0549	0.055	0.0545	0.1365	0.224	0.055	0.1	0.11	0.193	0.1	0.1	0.1	0.1	0.1	0.1	0.03	0.03
Antimony (µg/L)	90th %ile	Median	1	1	1	3.75	1	5	5	3.75	5	1	5		14	14	5	5	
Arsenic (µg/L)	90th %ile	Median	5	5	5	5	5	5	5	5	9.2	5	5		5	5	12.1	12	
Cadmium (mg/L)	90th %ile	Median	0.0435	0.044	0.0435	0.0435	0.039	0.044	0.044	0.044	0.0435	0.044	0.0435	0.0435		0.045	0.0442	0.0075	0.0075
Chromium (mg/L)	90th %ile	Median	0.0395	0.04	0.0395	0.0395	0.032	0.04	0.04	0.04	0.0395	0.04	0.0395	0.0395		0.042	0.0406	0.025	0.025
Copper (mg/L)	90th %ile	Median	0.043	0.043	0.043	0.043	0.035	0.043	0.043	0.075	0.043	0.043	0.043	0.043	0.03	0.043	0.043	0.1	0.1
Iron (mg/L)	90th %ile	Median	0.292	0.225	0.256	0.503	0.613	0.804	0.539	0.245	1.255	0.122	0.1885	0.2428	0.155	0.588	0.588	0.025	0.0579
Lead (µg/L)	90th %ile	Median	1	1	1	2.5	1	5	5	2.5	5	1	5	1	5	5	5	5	5
Manganese (mg/L)	90th %ile	Median	0.0267	0.024	0.0253	0.1224	0.033	0.789	0.822	0.025	0.1084	0.025	0.0235	0.025		0.05	0.05	0.025	0.025
Mercury (µg/L)	90th %ile	Median	0.15	0.15	0.15	0.15	0.25	0.15	0.25	0.2	0.25	0.2	0.2	0.2	0.18	0.2	0.2	0.15	0.15
Nickel (mg/L)	90th %ile	Median	0.114	0.114	0.114	0.114	0.094	0.114	0.05	0.114	0.114	0.088	0.114	0.114		0.114	0.114	0.025	0.025
Selenium (µg/L)	90th %ile	Median	5	5	5	5	5	5	25	23	5	23	5	5		50	50	15	25
Silver (mg/L)	90th %ile	Median	0.058	0.058	0.058	0.058	0.047	0.058	0.05	0.058	0.058	0.055	0.058	0.058		0.058	0.058	0.025	0.025
Thallium (µg/L)	90th %ile	Median	0.5	0.5	0.5	0.5	4.5	0.5	5	5	4.5	5	0.5	5		18.5	18.5	5	5
Zinc (mg/L)	90th %ile	Median	0.0345	0.035	0.0345	0.0345	0.029	0.035	0.035	0.035	0.0345	0.035	0.0345	0.0345	0.027	0.044	0.0345	0.03	0.0285
Biological																			
Chlorophyll a (µg/L)	90th %ile	Median	5.019	2.14	2.67	5.181	1.755	1.282	4.732	3.31	3.949	2.562	2.086	2.322	1.392	2.458	2.67	3.044	4.255
Fecal Coliform (col/100 mL)	90th %ile	Median	332	116	201.2	1564	400	234	620	582	1025	1416	152.2	197	829	252	320	200	435

7.4 Pictures of Stations

Figure 7: Upstream picture at station BEA-1 (7/24/12)



Figure 8: Downstream picture at station BEA-1 (7/24/12)



Figure 9: Upstream picture at station BEA-1 (11/27/12)



Figure 10: Downstream picture at station BEA-1 (11/27/12)



Figure 11: Upstream picture at station BEA-2 (7/24/12)



Figure 12: Downstream picture at station BEA-2 (7/24/12)



Figure 13: Upstream picture at station BEA-2 (11/27/12)



Figure 14: Downstream picture at station BEA-2 (11/27/12)

